

WHAT IS CLAIMED IS:

1. A wiring material comprising tungsten or a tungsten compound as a main constituent,

wherein at least one inert element is include within the wiring material and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

2. A wiring material according to claim 1, wherein the tungsten chemical compound is a chemical compound of: one element, or a plurality of elements, selected from the group consisting of Ta, Ti, Mo, Cr, Nb, and Si; and tungsten.

3. A wiring material according to claim 1, wherein electrical resistivity of the wiring material is equal to or less than $40 \mu\Omega\cdot\text{cm}$.

4. A semiconductor device having a wiring comprising:

a metallic film comprising one element, or a plurality of elements, selected from the group consisting of W, Ta, Ti, Mo, Cr, Nb, and Si; a metallic compound film having said elements as main constituents; an alloy film of a combination of said elements; or a lamination film of thin films selected from the group consisting of said metallic film, said metallic compound film, and said alloy film,

wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

5. A device according to claim 4, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

6. A device according to claim 4, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

7. A device according to claim 4, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

8. A device according to claim 4, wherein the inert element other than the argon is Xe or Kr.

9. A device according to claim 4, wherein internal stress of the metallic film is from -1×10^{10} dyn/cm² to 1×10^{10} dyn/cm².

10. A device according to claim 4, wherein line width of the wiring is equal to or less than 5 μ m.

11. A device according to claim 4, wherein film thickness of the wiring is equal to or greater than 0.1 μ m, and equal to or less than 0.7 μ m.

12. A device according to claim 4, wherein the wiring is used as a gate wiring of a TFT

az
wnt.

13. A device according to claim 4, wherein resistance value per 1 square μm of surface area of a connection between the wiring and an aluminum wiring is equal to or less than $40\ \Omega$.

14. A device according to claim 4, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

15. A device according to claim 4, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

Q2 cont.
16. A semiconductor device having a wiring comprising:
a film having tungsten or a tungsten compound as a main constituent,
wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and
wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

17. A device according to claim 16, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

18. A device according to claim 16, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

19. A device according to claim 16, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

20. A device according to claim 16, wherein the inert element other than the argon is Xe or Kr.

21. A device according to claim 16, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from -1×10^{10} dyn/cm² to 1×10^{10} dyn/cm².

22. A device according to claim 16, wherein line width of the wiring is equal to or less than 5 μ m.

23. A device according to claim 16, wherein film thickness of the wiring is equal to or greater than 0.1 μ m, and equal to or less than 0.7 μ m.

24. A device according to claim 16, wherein the wiring is used as a gate wiring of a TFT.

25. A device according to claim 16, wherein resistance value per 1 square μ m of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40 Ω .

26. A device according to claim 16, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active

matrix type EC display.

27. A device according to claim 16, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

28. A semiconductor device comprising:

a wiring having a lamination structure comprising a film having tungsten or a tungsten compound as a main constituent, and a nitride film of tungsten,

wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

29. A device according to claim 28, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

30. A device according to claim 28, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

31. A device according to claim 28, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

32. A device according to claim 28, wherein the inert element other than the argon is Xe or Kr.

A² level,

33. A device according to claim 28, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from -1×10^{10} dyn/cm² to 1×10^{10} dyn/cm².

5
SUB C1 7

34. A device according to claim 28, wherein line width of the wiring is equal to or less than 5 μ m.

35. A device according to claim 28, wherein film thickness of the wiring is equal to or greater than 0.1 μ m, and equal to or less than 0.7 μ m.

SUB B 8

36. A device according to claim 28, wherein the wiring is used as a gate wiring of a TFT.

SUB C1 7

37. A device according to claim 28, wherein resistance value per 1 square μ m of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40 Ω .

20
Pub C3

38. A device according to claim 28, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

39. A device according to claim 28, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

40. A semiconductor device comprising:

a wiring having a lamination structure containing a silicon film having an added impurity element for imparting conductivity, a film having tungsten or a tungsten compound as a main constituent, and a nitride film of tungsten,

5 wherein at least one inert element is include within the wiring and argon is contained in the inert element at an amount equal to or greater than 90%, and

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm.

10 41. A device according to claim 40, wherein the wiring is formed by a sputtering method using argon as a sputtering gas.

*Q3
wired.*
42. A device according to claim 40, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 1 atom%.

15 43. A device according to claim 40, wherein an inert element other than argon is contained within the wiring at an amount equal to or less than 0.1 atom%.

20 44. A device according to claim 40, wherein the inert element other than the argon is Xe or Kr.

45. A device according to claim 40, wherein internal stress of the tungsten film or of the film having the tungsten compound as its main constituent is from -1×10^{10} dyn/cm² to 1×10^{10} dyn/cm².

Sub C17

46. A device according to claim 40, wherein line width of the wiring is equal to or less than 5 μm .

47. A device according to claim 40, wherein film thickness of the wiring is equal to or greater than 0.1 μm , and equal to or less than 0.7 μm .

Sub B10

48. A device according to claim 40 wherein the wiring is used as a gate wiring of a TFT.

Sub C17

49. A device according to claim 40, wherein resistance value per 1 square μm of surface area of a connection between the wiring and an aluminum wiring is equal to or less than 40 Ω .

50. A device according to claim 40, wherein the semiconductor device is an active matrix type liquid crystal display, an active matrix type EL display, or an active matrix type EC display.

51. A device according to claim 40, wherein the semiconductor device is a video camera, a digital camera, a projector, a goggle type display, a car navigation system, a personal computer, or a portable information terminal.

Sub A1

52. A semiconductor device comprising:

a wiring comprising tungsten formed over a substrate,

wherein at least one inert element is include within the wiring and argon is

contained in the inert element at an amount equal to or greater than 90%,

wherein an amount of sodium contained within the wiring material is equal to or less than 0.3 ppm, and

wherein internal stress of the film comprising tungsten is from -1×10^{10} dyn/cm² to 1×10^{10} dyn/cm².

5

53. A method of manufacturing a semiconductor device having at least a wiring on an insulating surface, comprising the steps of:

forming a tungsten film by a sputtering method; and
patterning a tungsten film.

10

54. A method according to claim 53, wherein the sputtering method uses a tungsten target having a purity equal to or greater than 4 N.

55. A method according to claim 53, wherein the sputtering method uses a tungsten alloy target having a purity equal to or greater than 4 N.

15

56. A method according to claim 53, wherein the sputtering method uses only argon as a sputtering gas.

57. A method according to claim 53, wherein the sputtering method is performed at a substrate temperature equal to or less than 300°C.

20

58. A method according to claim 53, wherein the sputtering method is performed at a gas pressure from 0.1 Pa to 3.0 Pa, preferably from 1.0 Pa to 3.0 Pa.

25

59. A method according to claim 53, wherein the sputtering method is performed at a gas pressure from 1.0 Pa to 2.0 Pa.

SUB. 7
5 of:
60. A method of manufacturing a semiconductor device, comprising the steps
forming a tungsten film on an insulating surface by a sputtering method;
and
patterning a tungsten film,
wherein only argon is used as a sputtering gas during the sputtering
10 method.

61. A method according to claim 60, wherein the sputtering method uses a tungsten target having a purity equal to or greater than 4 N.

15 62. A method according to claim 60, wherein the sputtering method is performed at a substrate temperature equal to or less than 300°C.

63. A method according to claim 60, wherein the sputtering method is performed at a gas pressure from 0.1 Pa to 3.0 Pa, preferably from 1.0 Pa to 3.0 Pa.